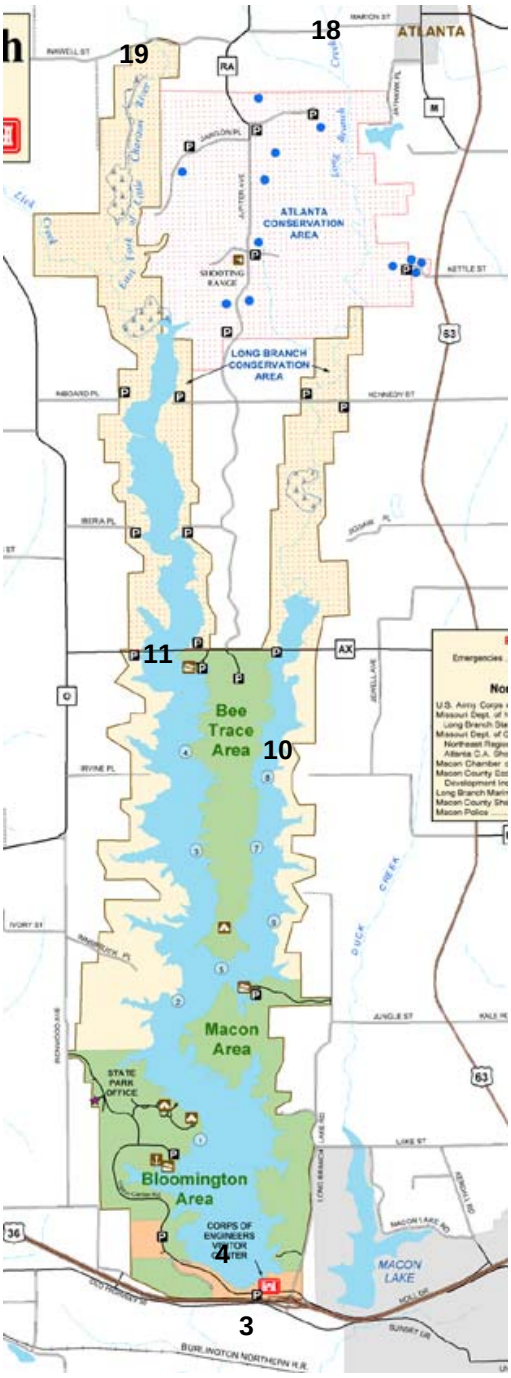
8 Long Branch Lake

8.1 General Background

Long Branch Lake was impounded in 1978 and reached full pool on 19 May 1981. The main threats to water quality at Long Branch Lake are nutrients, herbicides / pesticides, sedimentation, and bacterial contamination. The lake is currently listed on Missouri's 303(d) list of impaired waters due to atmospheric mercury deposition (MDNR 2004). Cyanazine was removed as a pollutant of concern at Long Branch Lake in 2002 (MDNR 2004). The long-term average (0.52 ug/L) dropped below the federal health standard of 1 ug/L. Cyanazine production ceased in 1999.



An AgNPS SALT Project was initiated in 2004 within the Long Branch Lake watershed. This project, designed to operate through 2010, is directed to improve agricultural BMPs and related water quality impairments.

The Corps had an 1135 project slated for Long Branch Lake, but funding limitations prevented development of the project. Another attempt was made with MODOT as part of a wetland mitigation project, but that fell through as well. The lake staff are currently coordinating with the local Army National Guard unit to construct berms in the upper reaches of both lake arms. The focus of in-lake projects are sediment control and bank erosion.

8.1.1 Location

The dam located on the East Fork of the Little Chariton River impounds Long Branch Lake. The dam is located 110 km (69 miles) upstream of the confluence of the Chariton River with the Missouri River. The lake is located 3.2 km (2 miles) west of Macon, in north-central Missouri. Historic water quality sample sites include 3 lake, 1 outflow, and 2 inflow (Figure 8.1).

8.1.2 Authorized Purposes: Flood control, water supply, fish and wildlife management, and downstream water quality improvement.

Figure 8.1. Long Branch Lake area map with sample site locations and sample numbers.

8.1.3 Lake and Watershed Data

Pools	Surface Elevation (ft. above m.s.l.)	Current Capacity (1000 AF)	Surface Area (A)	Shoreline (miles)
Flood Control	801.0	30.3	3,670	
Multipurpose	791.0	34.2	2,430	24
Total		64.5		

Total watershed area: 109 sq miles (69,700 A)

Watershed ratio: 19.0 FC / 28.7 MP

Average Annual Inflow: 81,780 acre-feet
Average Annual outflow: 000 acre-feet
Sediment inflow (measured): 483 acre-feet (1978 – 1988)

8.2 2005 Activities

Long Branch Lake was categorized as an 'ambient' lake during 2005, thus only surface water quality samples were collected at the three lake sites (see Figure 8.1). Samples were collected monthly from May through September, and single vertical profile was recorded during August. Long Branch Lake staff (OF-LB) providing field sampling assistance during 2005 included Mike Monda and Lucius Duerksen. Paul Sampson, OF-LB Operations Manager, provided insight and background regarding Long Branch Lake. The NWK Water Quality Program was contacted by MDNR regarding their interest in re-writing the Long Branch Lake watershed management plan.

8.3 2005 Data

Comparative historic water quality data consists of monthly (April – September) data collected from 1995 through 2004 / 2005.

8.3.1 Inflow

No inflow samples were collected from Long Branch Lake during 2005.

8.3.2 Lake

Long Branch Lake is a eutrophic waterbody based upon total nitrogen (TN), total phosphorus (TP), and chlorophyll *a* measurements. Total nitrogen median concentrations (0.93 – 1.2 mg/L) are similar for all three lake sites and the outfall (Figure 8.2). However, elevated TN concentrations historically have been measured at Site 18 (Figure 8.3). This site is located on Long Branch Creek and is just outside of the City of Atlanta. With few exceptions, all TN measurements have exceeded EPA's proposed ecoregional nutrient criteria value of 0.36 mg/L.

Total phosphorus median concentrations (0.07 – 0.13 mg/L) at lake sites are typical of Midwestern reservoirs (Figure 8.4). However, similar to TN, elevated TP concentrations

have been measured in the watershed at Site 18 (Figure 8.5). The median TP concentration at Site 18 (0.27 mg/L) is significantly higher than the lake sites.

The ratio of TN:TP can be used as a surrogate to determine the dominant algal community within a waterbody. Ratios ≥ 20:1 are indicative of desirable algal communities, whereas ratios ≤ 12:1 are indicative of bloom-forming cyanobacteria (blue green algae). As would be expected, there is high monthly and annual variability in the TN:TP ratio at all sites; see Figure 8.6 as an example at Site 2. Median TN:TP ratios at all three lake sites (Sites 11, 10 & 4) are ~ 12, indicating the lake is at risk for cyanobacteria blooms (Figure 8.7). The microcystin toxin has been collected from Long Branch Lake during 2000 (Dr. Jennifer Graham, USGS, personal communication).

Mean chlorophyll *a* concentrations range from 6 to 30 ug/L, with highest values measured at Site 11 (Little Chariton River arm) and lowest values near the dam (Figure 8.8). The chlorophyll values are the highest measured within the district, and indicate the significant nutrient loading within the lake. Secchi depth ranged from 0.3 to 0.6 m during 2005, indicating limited water clarity within the lake.

Atrazine samples were not collected during 2005. Between 1996 and 2004, median atrazine concentrations (0.7 – 1.8 ug/L) were less than EPA's drinking water maximum contaminant level of 3 ug/L (Figure 8.9). However, individual samples measured during the same time period were significant to greatly exceed the MCL. Figure 8.10 depicts individual sample concentrations measured by date at Site 19 (Little Chariton River inflow).

A single vertical profile was recorded during the 9 August sampling trip. Parameters included temperature, dissolved oxygen, pH, conductivity, and turbidity. Based on this profile, the lake was chemically stratified between 2-3 m and thermally stratified at 6 m (Figure 8.11).

8.3.3 Outflow

No outflow samples were collected from Long Branch Lake during 2005.

8.4 Future Activities and Recommendations

Sampling activities for 2006 will include transition to monthly 'intensive' monitoring from April through September, as well as conducting monthly vertical profiles at each of the two lake sites. Interactions will continue with MDNR on efforts to re-write the watershed management plan.

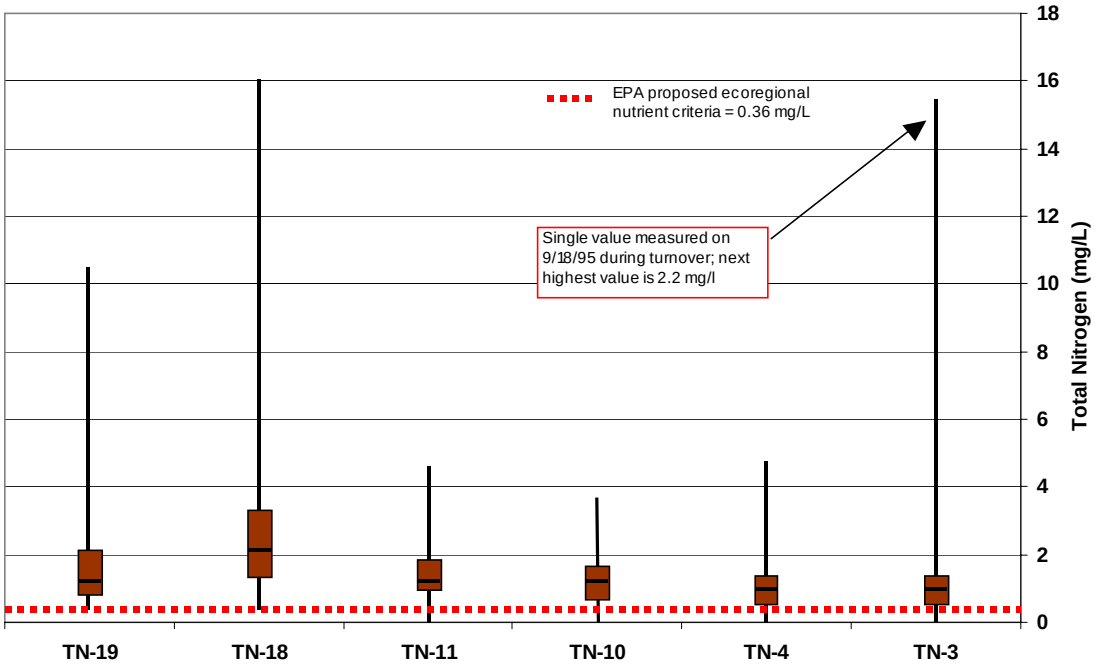


Figure 8.2. Box plots of surface water sample total nitrogen concentrations measured by site from 1996 through 2005 at Long Branch Lake.

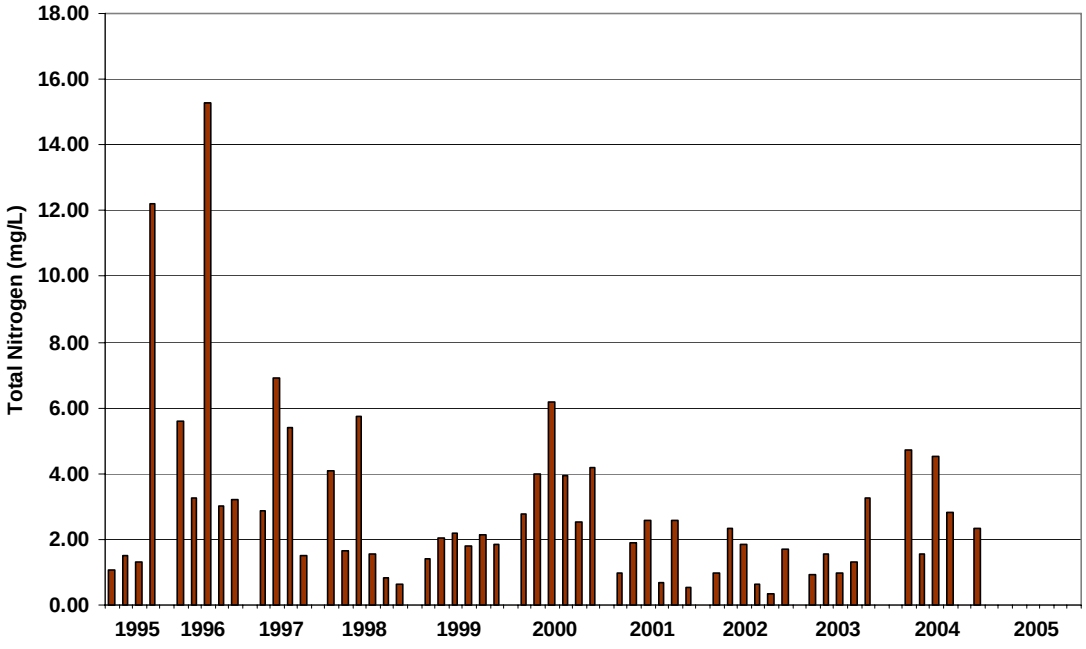


Figure 8.3. Total nitrogen concentrations by sample date at Site 18 (Long Branch Creek) within the Long Branch Lake watershed from 1995 through 2004.

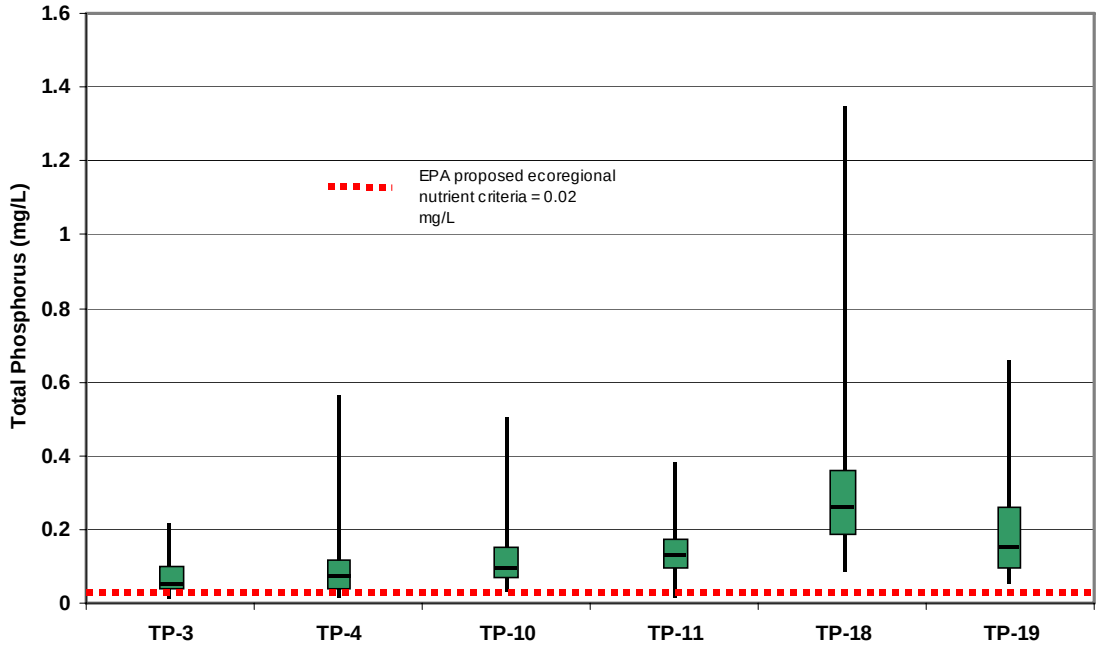


Figure 8.4. Box plot of surface water sample total phosphorus concentrations measured by site from 1996 through 2005 at Long Branch Lake.

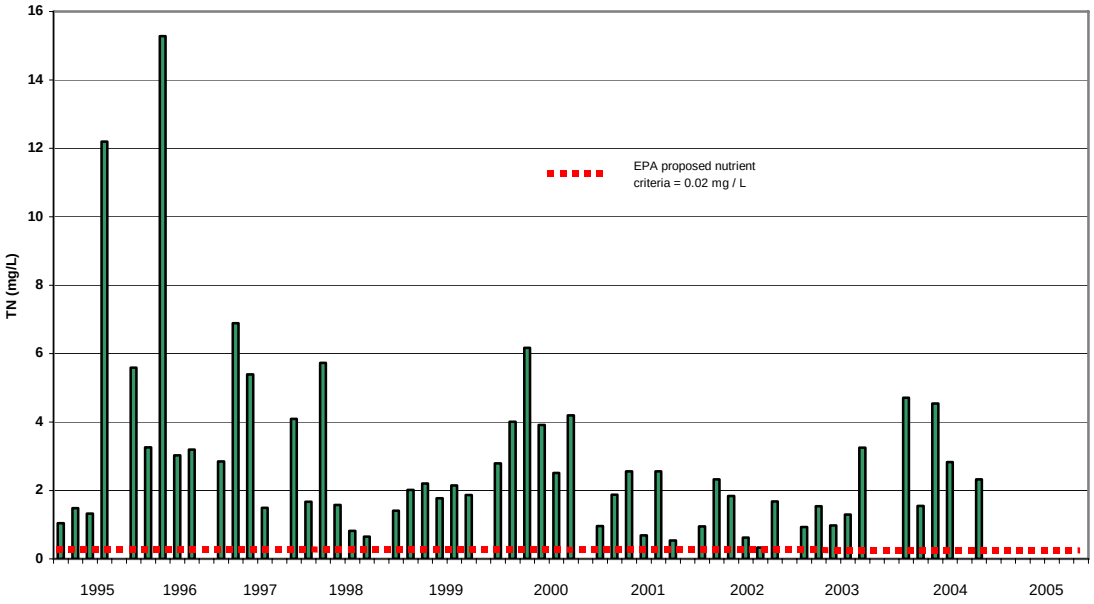


Figure 8.5. Total phosphorus concentrations by sample date at Site 18 (Long Branch Creek) within the Long Branch Lake watershed from 1995 through 2004.

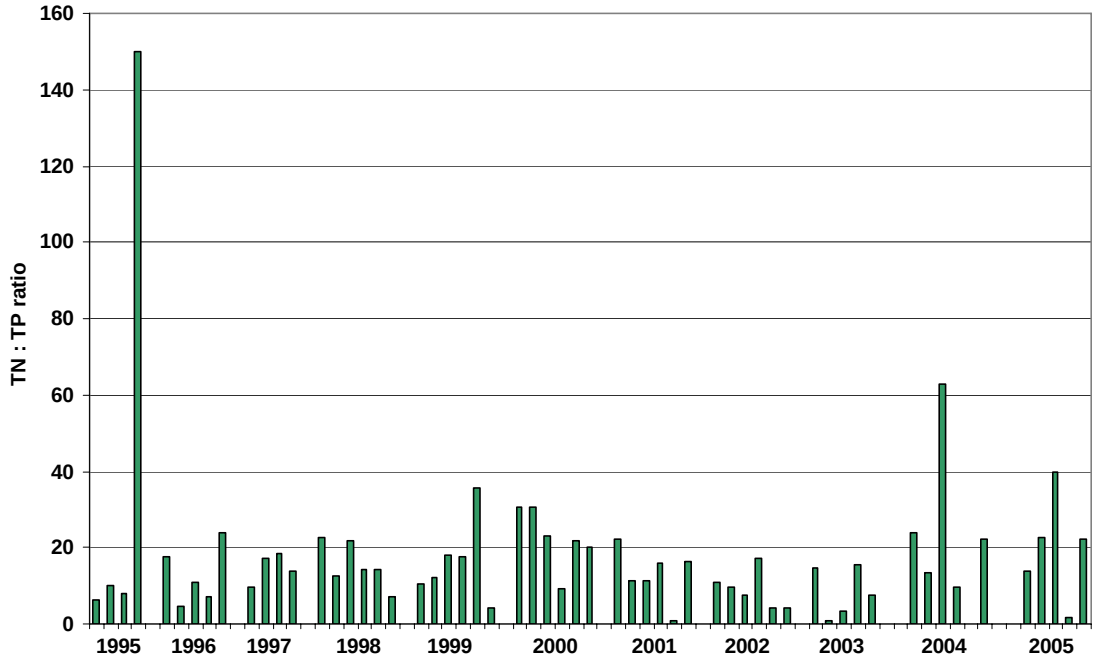


Figure 8.6. Graph of total nitrogen : total phosphorus ratio (TN:TP) by sample at Site 4 of Long Branch Lake from 1996 through 2005.

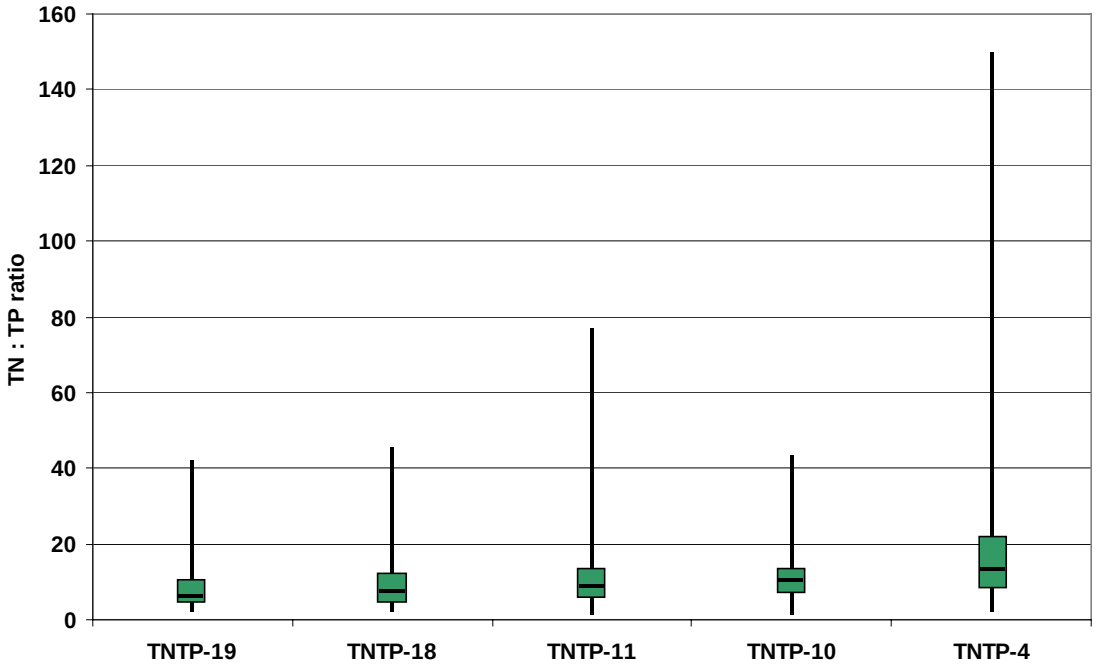


Figure 8.7. Box plots of total nitrogen : total phosphorus (TN : TP) ratio by site from 1996 through 2005 at Long Branch Lake.

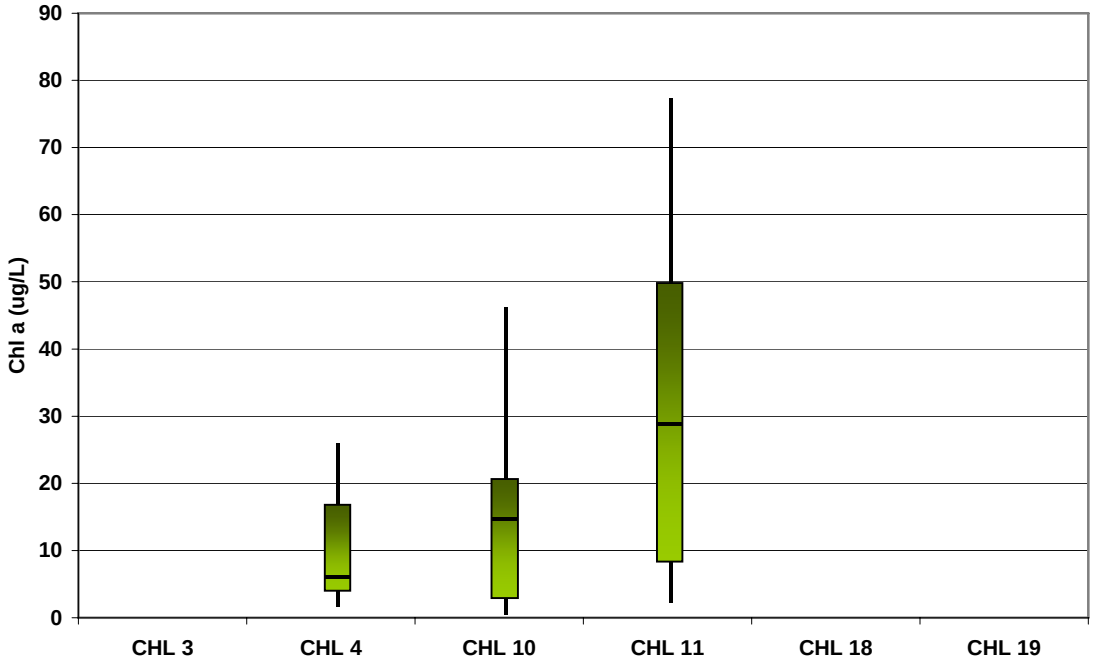


Figure 8.8. Box plots of chlorophyll a concentrations by site from measurements collected from 1996, 1997 and 2005 at Long Branch Lake.

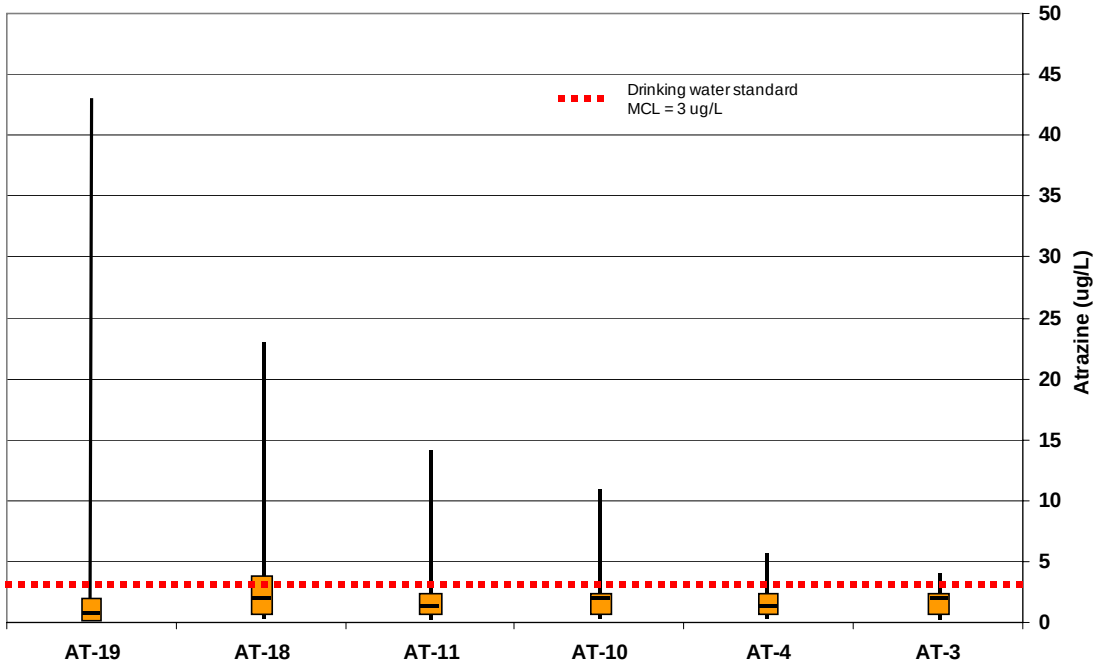


Figure 8.9. Box plot of surface water sample atrazine concentrations measured at lake sites from 1996 through 2005 at Long Branch Lake.

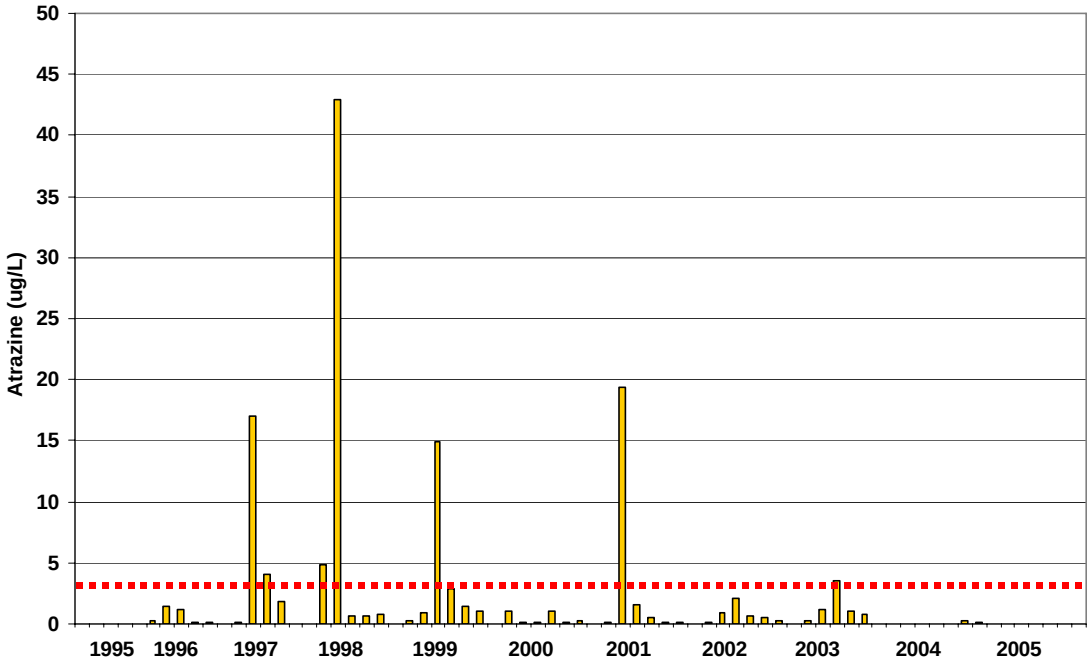
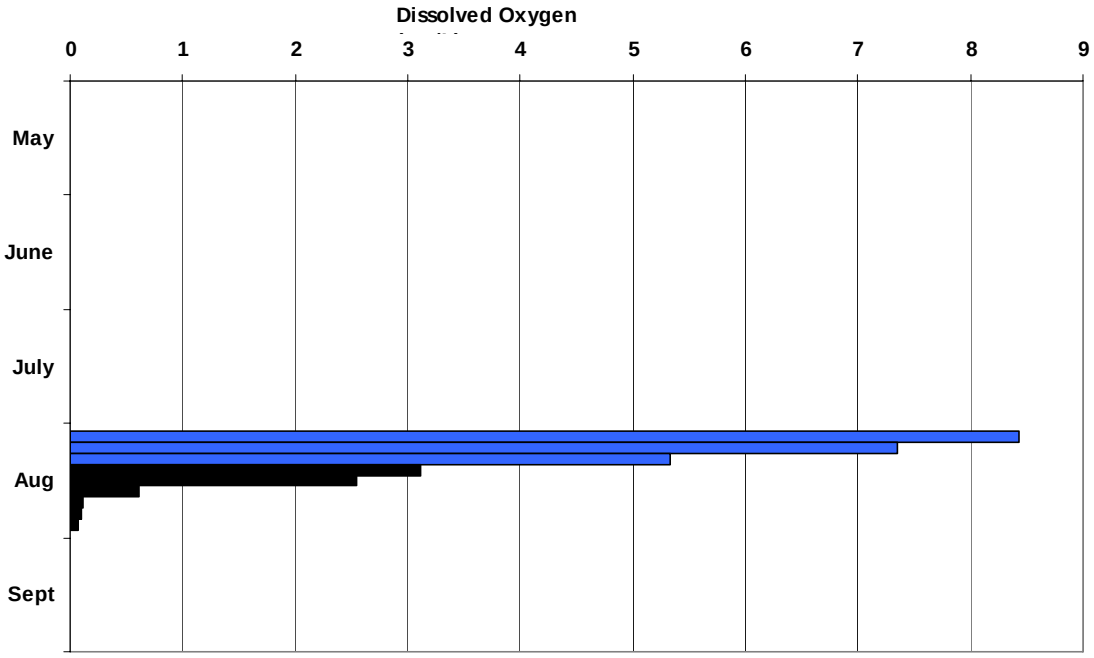


Figure 8.10. Atrazine concentrations by sample date collected at Site 19 (Little Chariton River) inflow to Long Branch Lake from 1995 - 2004.



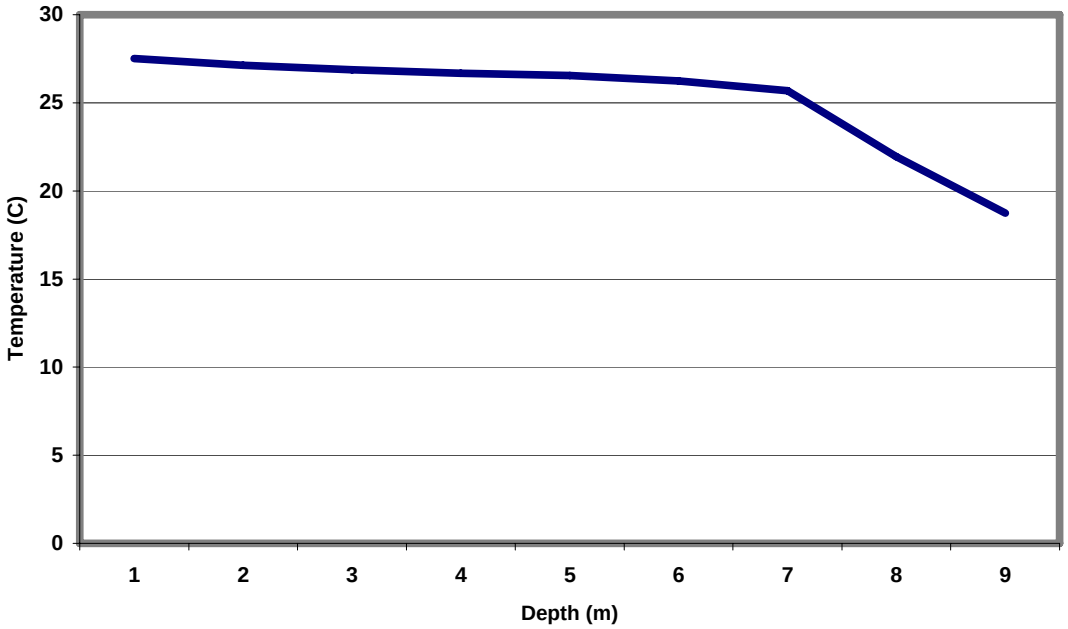


Figure 8.11. Dissolved oxygen concentration (mg/L) histogram and temperature (C) plot from a vertical profile recorded at Site 4 during 9 August 2005 at Long Branch Lake.